NOTES FROM PACIFIC COAST OBSERVATORIES.

A Comparative Study of the Spectra of the Limb and Center of the Sun.

[ABSTRACT.]

Solar spectra, corresponding to points at the center and near the limb of the Sun's disk, were photographed side by side on the same plate with a Littrow or auto-collimating spectrograph of eighteen feet focal length, used in conjunction with the Snow telescope of the Mt. Wilson Solar Observatory. The third or fourth orders of a four-inch plane grating, having 14,438 lines to the inch, were employed. For the measurement of line displacements, spectra were photographed at points near the limb lying at opposite ends of a solar diameter, thus permitting the rotational shifts to be eliminated. Some of the more recent work has been done with a Littrow spectrograph of thirty feet focal length, used with the new vertical cœlostat or "tower" telescope of the Solar Observatory. This instrument is of the same focal length as the Snow telescope (60 feet), and thus the diameter of the solar image is about 6.7 inches in each case. The four-inch grating, when used with the thirty-foot spectrograph, gives a scale of $1^{mm} = 0.58$ Ångströms in the third order and $1^{mm} = 0.44$ Ångströms in the fourth order. As the Fraunhofer lines are fairly sharp on the photographs, this great scale permits a high degree of precision to be attained in their measurement. Up to the present time most of the work has been done in the region λ 3800–λ 5800. It is therefore quite possible that the preliminary results given in this paper may not apply below *D*, or in the ultra-violet. These results may be summarized as follows:—

1. Most of the lines shown by our photographs of spot spectra to be strengthened or weakened in sun-spots, are similarly affected near the limb.
2. Many lines not affected in spots are strengthened or weakened near the limb.
3. Lines due to substances of high atomic weight are, in general, greatly weakened near the limb.

4. Winged lines undergo marked change in appearance, the wings being greatly reduced near the limb.
5. Among the lines considerably strengthened near the limb the most important are due to elements of comparatively low atomic weight. These include the *D* lines of sodium, the *b* lines of magnesium, and the blue calcium line at λ 4227.
6. Most of the lines in the spectrum are slightly widened near the limb.
7. Most of the lines are shifted toward the red, as compared with their position at the center of the Sun.
8. These displacements are not due to ascending currents at the center of the Sun (which would produce negative displacements of the lines in the solar comparison spectrum), since they have also been measured with the aid of an arc comparison spectrum.
9. The magnitude of the shift varies for different lines of the same element.
10. The strengthened lines, as a rule, seem to show smaller shifts than do the other lines.
11. The spark lines of a given element, as a rule, show larger shifts than do the other lines.
12. In many cases the relative displacements of the lines agree fairly well with those obtained by HUMPHREYS in his laboratory experiments on the effect of pressure on wave-length.
13. The lines of the cyanogen flutings (λ 3883.5 and λ 4216.14) are not shifted from their normal positions.
14. The shifts of groups of titanium lines near λ 3900, λ 4500, and λ 5300, and of groups of iron lines near λ 3800, λ 4400, λ 4900, and λ 5500, show progressive increase toward the red, and seem to indicate that the average pressure shift, for similar lines, is a function of the wave-length.
15. Photographs taken at intermediate points between center and limb indicate that the shifts fall off rapidly, and become very small at a short distance from the limb.

As our investigation is being continued, we reserve a discussion of these results, and their bearing on the earlier work of HALM, for a future paper.

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